DOCUMENT RESUME

ED 221 155 IR 010 151

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TITLE Numbering Systems in Text [and] Dimensions of Quality in Educational Texts. Notes on Transforming: 4 (May 1977), and 5 (January 1978).
INSTITUTION Open Univ., Walton, Bletchley, Bucks (England). Inst. of Educational Technology.
PUB DATE 78
NOTE 27p.; For related documents, see IR 010 011-013.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Design Requirements; Foreign Countries; *Instructional Design; Layout (Publications); Models; *Textbook Preparation; Textbook Publication
IDENTIFIERS *Distance Education; *Open University (Great Britain); Text Structure

ABSTRACT

These two papers discuss ways of improving the quality of educational texts used by the Open University in distance learning courses. The first discusses how text numbering systems should be used and when it is appropriate to use them; five recommendations are given. The last paper discusses how instructional design teams can best approach decisions about the presentation of course units. It is concluded that the quality of text presentation is a function of many interconnected factors. (LLS)

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NOTES ON TRANSFORMING

by

Robert Waller

4: Numbering Systems in Text, May 1977

5: Dimensions of Quality in Educational Texts, January 1978

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Notes on transforming 4 / Robert Waller / May 1977

NUMBERING SYSTEMS IN TEXT

Numbering systems are used to organise information in many different ways. How should they be used and when is it appropriate to use them?

There is actually very little guidance available. None of the major style manuals or graphic design textbooks say very much on the subject. Information scientists have thought about the problems of using numbering systems to classify subject areas but not to organise educational texts. Psychological research on the role of short-term memory in the use of numbers is summarised by Gallagher (1974) and research on the legibility of numbers is discussed by Tinker (1963). They are sources of useful information on the design and readability of numerals but they do not attempt to offer advice on the application of numbering systems.

THERE'S NOT MUCH ADVICE AROUND

PERHAPS BECAUSE THE PROBLEM IS HIDDEN.

It is very easy to imagine that there is no problem. Firstly, reference books, instructional or service manuals, and rule books - the sort of publications that use numbering systems - are less accessible and visible than other publications. Secondly, one of the frequent effects of a numbering system is to make information look well organised, even when it is not.

BUT TAKE A LOOK AT SOME O.U. TEXTS

But there is a problem and we have it at the Open University. Here are some examples.

- MST281

The correspondence texts for this course are numbered 1, 2, 3, 4, 5, 7, 8, 9, 11, 10, 13, 14, 15, 16. The reason why 14 units are numbered from 1 to 16 is that units 6 and 12 are 'rest' periods to allow students to catch up. A unit is not a text, apparently, it is a week's work. Well, usually ... but no-one seems very sure what it is. There is probably also a very good reason why mathematicians have used the interesting numerical sequence 8, 9, 11, 10, 13.

- PE261

Some units of this recently replaced course use as many as seven different numbering systems - unconnected in any way. There are separate systems for paragraphs, activities, footnotes, tables, figures, parts, pages.

- D203

The main teaching text in Block 11 starts with Part 2. Part 1 is the introduction. Part 2 has its own introduction in addition, as does Section 1 of Part 2.

- A201

This course uses as many reference systems as it has authors. Unit 1, for instance, is divided into sections with paragraphs numbered

separately - thus, section 3 starts with paragraph 19). Units 4, 17, 19 and 28 only have section numbers. Units 8-10 are bound together and number their paragraphs continuously - thus unit 8 starts with para. 1, unit 9 with para. 118, and unit 10 with para. 142. Units 20-27 have yet another system: units 20 and 21 contain sections 10.0-16.2 although the contents are also organised as Topics 1-X; units 22 and 23 contain sections 20.0-23.2 and units 24 and 25, sections 30.0-34.10 and so on.

PHEW!

If our numbering systems were the products of careful planning and were as consistent and rational as the term implies, they would surely not defy description in this way. Their chaotic state seems to reflect confusion about their purpose.

WHAT ARE THEY USED FOR?

Numbering systems are used for two main purposes. Firstly they provide a means of reference. It is useful to be able to refer to particular parts of texts for several reasons - for cross-reference within a text, for course team discussions of drafts, for tutorial discussions of units and so on. Secondly, numbering systems are often used to display the relative status of difference parts of the text - thus the sequence 1, 1.1, 1.1.1 describes three levels of a hierarchy.

FOR CROSS-REFERENCE

AND TO SHOW THE STRUCTURE OF THE TEXT.

The two uses of numbers are obviously related - something labelled 3 must be preceded by something labelled 2, and order of presentation often implies relative status. Nevertheless the distinction between reference and structural purposes of numbering systems is a useful one. It is useful because it isolates the source of most of the confusions we have found - namely the misuse of structured numbering systems.

STRUCTURED NUMBERING SYSTEMS HAVE SERIOUS DEFECTS

Whereas reference-only systems (like page numbers) are neutral and status-free, structured systems embody all the deep curriculum design and writing problems that authors of educational texts will always have. Although such systems may be entirely appropriate in some publications - Acts of Parliament, for instance or parts catalogues - they have some rather insidious effects on educational texts.

THE CODING IS HARD TO UNDERSTAND...

Firstly, they are cryptic. The principles of a structured system are almost never explained and only exceptionally well-thought-out and well-applied systems are self-explanatory. One difficulty arises from the fact that these systems look like ordinary numbers and yet use mathematical notation in quite different ways. Whereas 1.1 and 1.10 normally represent the same number, in a numbering system they may both be part of the sequence 1 0, 1.1, 1.2 ... 1.9, 1.10, 1.11. Systems with this many items in a sequence usually go to 1.1.1 for the next level in the hierarchy, while systems that never get as far as 1.9 often use 1.11 to mean the same thing.

AND IS VISUALLY UNCLEAR.

Even when the notation is clear, numbering systems are still inadequate when used on their own to show the structure of a text: 1.12.3, for instance, does not look very different from 1.12.4 - most of the digits have remained the same. There is a useful rule of thumb that says 'Precise construction does not guarantee accurate perception'. Applied here it means that the signalling of a new section of text will need more than a change of one digit in a long marginal number - it may also require extra 'redundant' signals like a line space, or an indent or a subheading.

FEW TEACHING TEXTS ARE GENUINELY HIERARCHICAL

Secondly, structured numbering systems are insincere - that is, they purport to aid the reader while in fact they so often mislead. Textbooks rarely have the sort of structure that numbering systems display. These systems originate in taxonomies - classifications of things or concepts. They are hierarchical organisations of items that claim to be both complete and discrete - that is, there is nothing outside them that should be in, and there is nothing included that should not be. These are not claims that Open University course units should be making. The concepts, arguments, facts, examples and so forth that make up an academic discipline are connected not as a hierarchy but more as a network. The nature of written language, though, means that subjects have to be represented in a linear way. It is part of the skill of a good teacher to structure ideas for the purpose of explanation without preventing the student perceiving the network in the way that suits him best. It is not easy to make all the necessary connections and allusions without losing the thread of an argument. It certainly cannot be done without some redundancy - some ideas have to be mentioned more than once. Structured numbering systems, though, imply that the ideas mentioned in paragraph 2.2, for example, are definitely in a different branch of the hierarchy from, say, para. 8.6.2. The chaotic state of many of our numbered texts results from the fact that authors find that this is not so. Not only do subjects not fit easily into hierarchical prose, but the systems are unable to cope with the various other kinds of discourse that also appear in teaching texts - questions, study hints, summaries and so on.

AND THEY CREATE THE WRONG ATMOSPHERE

Thirdly, numbering systems are officious - they give Open University texts a rather phoney air of authority. They reinforce the insidious notion that originates from the educational technology of programmed learning and that quietly lives on in many OU courses - the notion that textbooks are static and can only be read in one way. Although course units often are excellent examples of scholarship they must nevertheless remain 'tutorials in print', maintaining the distinction between correspondence texts and set books. Numbering systems contribute to an atmosphere of closedness and precision that is out of place. Some of the original sources for numbering systems are illustrated at the end of this paper. They are all texts whose essential qualities include thoroughness, precise ordering of thought and language, and authority. It is worth mentioning that numbering systems in texts are not the only numbers the Open University uses - we also number everything else in our educational system that is quantifiable - students, tutors, assignments, courses, study centres, regions, weeks of the year, broadcasts and so on. These all set up a relationship between teacher and learner that is hardly welcoming to the beginning student; they also add considerable poignancy to the term 'distance-teaching'.

NUMBERING FOR CROSS-REFERENCE

Besides structuring the text the other main purpose of numbering systems is to provide a means of cross-reference. To discuss reference systems, though, brings us back almost immediately to a discussion of the hierarchical numbering systems that we have just left - because the most common sort of cross-references in texts are references to concepts. And concepts are what structured systems purport to display.

To refer to a concept solely by number, however, is inadequate. A reference like 'see 3.1' is ambiguous on two counts. As an instruction it is too vague - should the reader re-read or just glance at 3.1? As a connector of ideas it also fails. It neither reminds the reader of the content of 3.1 nor tells him why it is significant.

Instead I would suggest that numbering systems should only be used to refer to locations in the text, and to genuinely quantifiable series of items. 'Locations' means pages; series of items include figures, exercises or activities, tables and broader subdivisions of texts such as chapters or parts.

PAGE NUMBERS ARE FINE ...

A corollary to the advice 'use page numbers only' is a notion that will be discussed in a later paper - 'use plenty of sub-headings and marginal notes'. These not only restore the specificity of reference that is lost where structured paragraph numbers are left out, but the significance of reference to a sub-heading is self-explanatory.

BUT FIGURES, TABLES ETC CAUSE MORE PROBLEMS ...

Page numbers need little comment but the numbering of series is more problematical. The reader finds the right page by flicking through the book looking at all the page numbers until he finds the right one. He is using the context of the series to find the particular page he wants. In most publications page numbers appear on every page and there is no problem; but although tables and figures have to be located in exactly the same way, there are often very few of those. In other words, to find Figure 3 means finding Figure 2 or Figure 4 first. If there are only a few diagrams in the whole book, context is little help to the reader. The alternative, referring to "Figure 3 on page 32", sounds like an admission of defeat by the editor.

ESPECIALLY WHEN THERE ARE ONLY A FEW ...

SO WHY NOT COMBINE THEM WITH CHAPTER NOS?

One quite promising solution to this problem may be to use the division of the book into chapters to narrow down the field of search.

Thus tables 1, 2 and 3 may, instead, be referred to as Table 2/1, Table 2/2 and Table 5/1. Oblique strokes are used instead of points to avoid confusion with decimal systems. It may also be possible to incorporate all numbered items in the same series - e.g. Table 5/1, Table 5/2, Exercise 5/3, Figure 5/4 etc.

WHAT NUMBERS SHOULD LOOK LIKE ...

Besides the context of the system, the sensible design and placing of the numbers are also important aids to the reader. Some design issues have been the subject of research. Tinker (1930) found little difference between the legibility of ranging numerals and the non-ranging numerals of Old-style typefaces which vary in vertical alignment. Perry (1952) showed conclusively that Arabic numerals are much superior to Roman. The numerals of all conventional printing types would, then, seem to be fine. It's worth noting at this point an interesting idea found in History of Architecture and Design (A305). The correspondence texts contain a large number of illustrations and the references to them in the text are printed in bold type. This helps readers who are browsing through the pictures to locate the text which discusses them.

AND WHERE TO PLACE THEM.

The placing of the reference numbers has not been the subject of experiment, although a greater variation is found in practice. It often happens, in typographic research, that the issues most often researched empirically are those that are least problematical and thus most easily and uncontroversially defined. The skill is to make the numbers prominent enough to see on scanning, but to ensure that they are not intrusive. In practice, this often means placing them in the margin rather than within the text, using discreet numerals in a prominent position. Instead of placing figure numbers or

References

Gallagher, C.C. (1974) The human use of numbering systems. Applied Ergonomics 5:4, 219-223.

Perry, D.K. (1952) Speed and accuracy of reading Arabic and Roman numerals. J. Applied Psychology 36: 346-7.

Tinker, M.A. (1930) The relative legibility of modern and old style numerals. J. Exp. Psych. 13: 453-61.

Tinker, M.A. (1963) The legibility of print. Iowa State University.

paragraph numbers (if used) always on, say, the left of the column of type, it will help the scanning reader most to place them consistently nearest the fore edge of the book - thus on right-hand pages they will be on the right and on left-hand pages they will be on the left. Two-column texts present different problems - numbers appearing between the columns require more space than is usually available in order to be clearly visible and unambiguous. Here, it may be best to place the numbers on the outside of the page - on the left of the left-hand column and on the right of the right-hand column. Texts with three or more columns may have to incorporate the numbers within the column of type.

CONCLUSIONS

Numbering systems are obviously not a primary problem of our educational system. But every component must be thought through if we are to produce functional and approachable texts.

For most educational texts, then, the 'best buy' system can be summarised as follows.

- use numbers mainly for reference. Chapter, page and figure numbers are almost always perfectly adequate for continuous prose texts.
- Consider incorporating figure numbers, exercise numbers and so on in the chapter numbering system; particularly when there are too few figures for easy location or when too many different systems would cause confusion.
- use arabic numerals not roman ones.
- place the numbers near the fore edge of the book so that it is easy to see them when flicking through.
- if in-text numbering has to be used place the numbers in the margin rather than within the column.

However, with the publication of *Principles of Geology* by another Scotsman, Charles Lyell, in 1830 the fate of the Neptunist was sealed. Lyell marshalled much evidence in support of Hutton's theory that rocks could be interpreted in the light of natural laws without invoking either divine intervention or catastrophic events. Lyell is often referred to as the 'father of historical geology'. As a result of his influence, many of the important developments in geology were accomplished by geologists working in Britain.

This is page 10 of S100, (the Science Foundation course), unit 26.

26.1.2 A modern coastal environment

The idea of interpreting the past in terms of the present sounds extremely simple, but there are many practical difficulties. An insight into the extent of these can be gained by considering a present-day environment from a geological point of view.

So, you should now read the section in Chapter 13 of *Understanding the Earth* entitled 'environmental analysis—the beach' (pp. 180–5).

When you read this section, examine Figure 14 in Appendix 3 (p. 34), which summarizes information on the sediments and faunas of a modern beach. Plate A and TV programme 26 are about this area. *Make sure you have examined Figure 14 thoroughly and have read pp. 180–5 of* Understanding the Earth* *given above before viewing the television programme.* The post-broadcast notes will refer you to Appendix 3 which describes a 'geological model' of this stretch of coast and summarizes the sequence of 'rocks in the making' in this environment.

There are cross-references to 6 different numbering systems, not including the 2 systems that identify this page (26.1.2 + p.10):

Chapter 13
pp. 180-5
Figure 14
Appendix 3+1
Plate A
TV prog. 26

Either now, or after you have viewed the TV programme, consider what you would measure on a present-day beach in order to describe quantitatively such an environment; pay particular attention to the materials and processes which would be preserved when the sediments became rocks.

You should compile your list under the following headings.

(1) Topography

(2) Climate

(3) Water conditions

(4) Flora and fauna

(5) Sediments

DO NOT READ ON UNTIL YOU HAVE ATTEMPTED TO MAKE A LIST.

* *See glossary (Appendix 1) for unfamiliar terms in set reading.*

The contents page of A291 units 13–16, uses 6 different numbering systems to describe 1 text.

- PART THREE
- 11.0–11.2 etc.
- (A) (B) (C) etc.
- 92 ... 142
- (i) (ii) (iii) etc.
- (a) (b) (c) etc.

Notice also how the page number for this page has been lined up with the column of page numbers that refer to the contents list.

PART THREE: THE DEVELOPING CHURCH

11.0–11.2	(A) OTHER FOUNDATIONS	92
11.3–11.16	Non-Pauline missionary activities	92
12.0–12.3	(B) THE FORMATION OF THE NEW TESTAMENT	96
13.0–13.3	(C) THE BELIEF OF THE EARLY CHURCH CONCERNING THE DIVINITY OF JESUS CHRIST	97
13.4–13.9	Christology: an exercise	99
13.10–13.11	Investigation of the New Testament data	101
13.12–13.17	(i) Data from *Acts*, reflecting the Christology of the early Palestinian church	103
13.18–13.33	(ii) Data from the Synoptic Gospels	103
13.34–13.44	(iii) Data from the Pauline letters	108
13.45–13.52	(iv) Data from the Fourth Gospel	111
13.53–13.55	(v) Data from other books of the New Testament	113
13.56–13.64	Christology and monotheism	115
14.0–14.2	(D) THE HOLY SPIRIT AND THE TRINITY	118
	(E) CHRISTIAN LITERATURE OF THE SUB-APOSTOLIC AGE	119
15.0–15.2	In the footsteps of the Apostles	119
15.3–15.18	Survey of the post-apostolic writings: (a) *1 Clement;* (b) The *Didache;* (c) the letters of Ignatius of Antioch; (d) *The Epistle of Polycarp*; (e) *The Epistle of Barnabas*; (f) The Apologists; (g) *The Shepherd of Hermas*; (h) *The Martyrdom of Polycarp*; (i) Papias; (j) anti-Gnostic writings	120
15.19–15.24	Two representative testimonies	124
	(F) THE GEOGRAPHICAL EXPANSION OF THE CHURCH	127
16.0–16.2	Bridgeheads and the first advance	127
16.3–16.10	Casting light backwards	128
16.11	Case-studies in church development	131
16.12–16.18	(a) Ephesus	131
16.19–16.39	(b) Rome	134
	(G) STRUCTURES, TRADITION AND SCRIPTURES	140
17.0–17.3	Threats to the Church's survival	140
17.4–17.5	The Church meets the challenge	141
17.6–17.9	(a) Structures of ministry and ecclesiastical government	142

society. ... application ... property ... revenues ... other purposes created a permanent vested interest opposed to any religious policy that might mean a restoration of monastic life. The impact on society of a large number of ex-monks and ex-friars, seeking other means of livelihood, was also considerable. The younger men among them were often 'advanced' in their views; from their ranks many of the most active leaders of the Reformation were to be drawn.

22.4.13 (c) CULTURAL FACTORS

(i) **The humanists** were at first almost all on Luther's side. The dispute that flared up after 1517, with the Dominicans in the forefront of the opposition to Luther, seemed to the friends and followers of Erasmus to be just another turn of the opposition of the Old Learning to the New. It seemed to be another Reuchlin case (cf. Koenigsberger and Mosse, pp. 107–8). Another attempt of obscurantism to stifle the new flowering of Christian ... top ...

Whose idea was this? More than one person's I imagine (from A201, unit 22)

This part of the contents list from the Open University House Style shows that numbering systems are not adequate to show the structure of text on their own. These numbers are mistakenly aligned at the right (like a sum). The longest and so most prominent numbers refer to the least important categories.

3 General Rules for Copy Preparation
3.1 General instructions
3.2 Standard page
3.2.1 Size
3.2.2 Typing
3.3 Headings
3.4 Sections, sub-sections
3.5 Footnotes
3.6 Cross references
3.7 Quotations
3.8 Figures and tables
3.8.1 Artwork
3.8.2 Tables
3.8.3 Captions
3.9 Spelling
3.9.1 ize/ise
3.9.2 Spellings to note
3.9.3 Ampersand (&)
3.9.4 Hyphens
3.10 Punctuation
3.10.1 Full stop (full point) /abbreviations
3.10.2 Parentheses
3.10.3 Comma
3.10.4 Quotation marks
3.10.5 Dash (em rule)
3.10.6 Omissions (ellipsis)
3.11 Capitals
3.12 Numerals
3.12.1 Decimal point
3.12.2 Dates
3.12.3 Time
3.12.4 Percentage in descriptive text
3.12.5 Page references
3.13 Italics/bold type
3.13.1 Titles
3.13.2 Foreign words and phrases
3.14 References
3.14.1 Text reference
3.14.2 Book
3.14.3 Journal
3.14.4 Government document
3.14.5 Open University references
3.15 SI units (The International System of Units)

5.5563 In fact, all the propositions of our everyday language, just as they stand, are in perfect logical order.—That utterly simple thing, which we have to formulate here, is not a likeness of the truth, but the truth itself in its entirety.

(Our problems are not abstract, but perhaps the most concrete that there are.)

5.557 The *application* of logic decides what elementary propositions there are.

What belongs to its application, logic cannot anticipate.

It is clear that logic must not clash with its application.

But logic has to be in contact with its application.

Therefore logic and its application must not overlap.

5.5571 If I cannot say a priori what elementary propositions there are, then the attempt to do so must lead to obvious nonsense.

5.6 *The limits of my language* mean the limits of my world.

5.61 Logic pervades the world: the limits of the world are also its limits.

So we cannot say in logic, 'The world has this in it, and this, but not that.'

Some origins of structured numbering systems

Philosophy (Wittgenstein)

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028 Reading and reading aids

.1 Book reviews

Class technique of book reviewing in 808.0660281, critical appraisal of literature in 800, reviews on a specific subject with the subject

.5 Reading of children and young adults

.52 Bibliographies and catalogs

If preferred, class in 010

.7 Use of books and other records as sources of information

.8 Use of books and other records as sources of recreation and self-development

Classification (Dewey)

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3. The Analytical Categories. Definitions and Rules for Selection

3.1 Nature of Injury

3.1.1 ***Definition.*** The nature of injury classification identifies the injury in terms of its principal physical characteristics.

3.1.2 ***General Rule.*** Name the basic injury rather than its sequelae.

3.1.3 ***Rules for Selection in Cases of Multiple Injuries***

3.1.3.1 When one injury is obviously more severe than any of the others, select that injury. For example: Select an injury involving permanent impairment in preference to a temporary injury.

3.1.3.2 When there are several injuries of different natures, such as cuts and sprains, no one of which is indicated as being more serious than the others, classify as "multiple injuries."

Procedures (methods for classifying industrial injuries)

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Notes on transforming 5 / Robert Waller / January 1978

DIMENSIONS OF QUALITY IN EDUCATIONAL TEXTS

How can course teams best approach decisions about the presentation of course units? This paper sets out and expands on some thoughts on this issue that were put to the Textual Communication Working Group of the T101 course team in Autumn 1977.

At the moment there is no general view of what presentation is, how it affects the quality of our courses, or how it can be evaluated and improved - yet we produce course units with sophisticated printing methods even for courses with only one or two hundred students a year. But although the Open University as an institution is in this sense committed to the view that presentation does matter, in practice few course teams manage to do it in more than a fairly haphazard way. For example, most course teams are organised so that designers only rarely attend course team meetings; courses are developmentally tested in rough typewritten drafts; sometimes strange decisions are reached, as in one course team that was recently asked

asked to use a smaller typesize because it would look more 'scientific'!

The approach taken by course team members to problems of presentation is often coloured by assumptions, prejudices or misunderstandings that have arisen in various ways. They may come from traditional textbooks that made few concessions to the student - it has sometimes been argued that badly organised texts are just one of the hoops that an academic training should make students jump through. Sometimes there is straightforward misinformation - for example a course team was recently told that the reason it could not use the wide margins for headings was that the cost of the extra two inches of film for the platemaking would be prohibitive. There might have been a good reason but that was almost certainly not it.

Sometimes the course team's approach is the result of a personal hobbyhorse of one particular member. It may be behavioural objectives, bias, reading purposes, headings, questions, readability, illustrations, typography or many others - all of these are current hobbyhorses of various IET members. There is an opposite effect too - all of us have gaps in our knowledge and so the advice we give will be biassed accordingly.

We would often like a theoretical framework or research data to inform our discussions. There are a number of disciplines or subject areas that we can turn to - psychology (of various kinds), sociology, educational technology, typography, literary criticism and so on. If we limit our attention to only one of these areas, though, our advice is bound to be biassed, because they all have very different suppositions about writers texts and readers.

For example, typographers sometimes see a text only as printed letters on paper, paying little attention to its content. A specialist in the subject of the text, on the other hand, might only be interested in the accuracy of the content. An educational technologist interested in the sequencing of the concepts lies somewhere between these two extremes. It is possible, in fact, to place the interests of many other specialists in a similar way.

Fig 1 displays this in a diagram. It ranges various different approaches to text on a continuum from 'message' to 'medium', borrowing from M Luhan's familiar catchphrase. This reflects the fact that in practice, if not in theory, you cannot usefully consider 'what to say' separately from 'how to say it'. The continuum is useful as a framework for course team discussion because it corresponds roughly to the course production process. This is essential if it is to be of use. It is the experience of many members of IET, both in course development and research, that any advice they give, however theoretically neat, must relate to the practical problems being experienced by course teams at any particular time. In fact, it is better that the advice is ready before the problems are met. It is essential that decisions taken at any particular stage take into account problems and opportunities that will be met at a later stage - so there is a need to consider all aspects of quality - whether they be of content or presentation - in a coordinated way. Fig 1 tries to do this practically as well as theoretically by relating the 'issues' to the division of tasks in the production system and also to the collection of student feedback for the evaluation and

M E S S A G E

Research area	Production system	Text	Reader	C T Discussion topic
Epistemics	Authors	Principles, facts, theories, issues, etc.	Prior knowledge, skills	Define teaching objectives e.g. what facts? What skills? Define potential readership.
Curriculum theory	Authors	Examples, cases, explanation, sequencing, etc.	Reading purpose (Prior knowledge + context + aptitudes)	Outline options for teaching particular skills/ knowledge in context of a range of reading purposes.
Structural or rhetorical analysis	Authors, Editor	Rhetoric, argumentation structural cohesion.	Analytic skills	Check for coherence of argument, and of links between different parts of course etc.
Psycho-linguistics	Authors, Editor	Vocabulary, syntax, tone etc.	Reading skills	Check for readability level, discuss guidelines for authors.
Educational psychology, typographic research	Authors, Editor, Designer	Questions, access structure, (summaries, headings, etc.)	Reading strategy (purpose+environment + aptitudes)	What to signal (what reading strategies to cater for. How to signal (format, typography)
Perception, typographic research	Editor, Designer	Print specification and quality	Visual acuity, graphic associations	Choice of typeface and layout: legibility, visual associations, availability of technical symbols, etc.

Fig. 1.
A continuum of factors affecting the quality of educational texts.

refinement of the text.

The first column lists some of the areas where research literature is available (to varying degrees of quality and quantity) to inform course team discussion, and course team evaluation.

The second column shows the span of responsibility of various roles. They vary, of course, according to individual skills and in different course teams. Just as it is hard to say where 'content' ends and 'presentation' begins on the continuum, so it is hard to say precisely where different roles divide. Some of the tensions that exist at present in our production system are at the borderlines between roles - between author and editor, and editor and designer. In the diagram these points of tension are represented by the overlap of lines. Obviously one person cannot do all the work or be completely familiar with all the problems. It is clear, though, that the various mechanisms for cooperation need careful managing - the course team, the 'handover' system, the house style, even the physical accessibility of individuals. The notion of 'transforming', that this series of papers is exploring does not therefore call for one super-human intellect so much as a team of people with appropriate skills working within an appropriate management structure, with the appropriate ethos and objectives.

The next three columns show in more practical terms the factors that affect the quality of a text. There are corresponding factors in both the reader and the text. Considered together they form 'research issues' for course teams to discuss, and to direct the collection of feedback from students. Problems of quality arise from a mismatch between the two - for example between the prior knowledge of

the reader and the specialist vocabulary used in the text.

'Quality' is a rather vague word - what is meant by it? and what is it that our careful course unit evaluation and developmental testing is meant to improve? If the mismatch idea is correct, then 'quality' means the effectiveness of the interaction of the student with the text. To evaluate this, then, we must look at both. We know quite a lot about the analysis of text from some of the research areas in the first column of the diagram, but the criteria for quality must ultimately be student-centred; the failure to accept this is a reason why some of these disciplines offer so little to practical communicators. Text cannot be judged from formal criteria, but must only be evaluated in relation to the purposes and achievements of its readers, in terms both of their personal and of institutional goals. So formal analysis of course content will not itself tell us whether it is biassed, or pitched at the right educational level, or interesting.

I have deliberately used the rather vague word 'quality' so as not to be misunderstood as assigning particular effects to particular levels on the continuum. Mismatches at any level can affect all aspects of the reader text interaction. It is a mistake to assume, for example, that 'motivation' is only affected by graphic design, or that graphic design only affects motivation. But when course teams (and, indeed, designers) discuss design it is often almost exclusively in this context. It is not necessarily true that superficial judgements are only made from surface-level features of text, or that more substantial judgements result exclusively from deeper levels of the text content. Instead, a whole range of conditions - from motivation (selection, attention, perseverance etc.) to learning

outcomes (recall, comprehension etc.) - may be affected by features of the text placed at any point in the continuum. People rarely select a book to read simply because it is well-designed; it is also because that book fills a need - personal or curricular - and it appears to be written at an appropriate level of language, entry knowledge and interest. Conversely, learning is not just affected by clear sequencing and explication of content. Educational psychologists have sometimes looked as far down the continuum as graphic design: Ernst Rothkopf has published a study of the effect of the position on the page of a fact on its ease of recall, and Phil Duchastel has recently circulated his ideas on the retentional role of illustrations.

What is the nature of the interaction between reader and text, whose effectiveness we have been discussing? Most models of the reading process are rather restricted in scope, being mainly concerned with the cognitive processes that enable readers to extract meaning from marks on paper. This may be theoretically interesting to some, but at the level of fluency we can expect from our students we are not likely to find many problems there. Instead it would be interesting to have a global model of the reading process, so that we might predict the effect of reader-text mismatches on reading behaviour.

Hatt (1976) presents an interesting framework for the discussion of the reading process, which is deceptively simple. It is based on three parts.

1. A reader finds a text.
2. He reads the text.
3. He uses the message (or not, as the case may be).

As we have seen, many theorists confine themselves to the cognitive processes that occur within 2. Most though, now reject the early information-processing model (Transmitter-message-receiver) as casting the reader in an unduly passive role. Instead we now see readers as not simply receiving messages but as seeking and finding them. Hatt extends this idea by studying patterns of entry and patterns of exit from the reading act.

A fault with Hatt's framework is that it appears to be unduly sequential. It may also be that aspects of all three of his behaviours can occur cyclically or simultaneously. Figure 2 uses column headings loosely based on Hatt's framework. All three parts are 'ongoing' rather than sequential. So reading cannot continue satisfactorily if there is no motivation, no effective strategy, or no outcome perceived by the reader.

The columns are open-ended and different observers may classify some things differently. But compare the factors in Fig 2 with the various levels of the continuum in Fig 1. Fig 1 relates the existing state of the perceived readers (knowledge, aptitudes etc.) to the assumptions made by the text. As we have seen, each level on the continuum may affect the experience of the readers at more than one stage in the process of reading and learning, as it is displayed in Fig 2.

A mismatch, for example, may be found at the level of readability; the syntax and vocabulary may be too difficult for a particular student who has done no full-time study previously, or for whom English is a second language. In terms of his reading behaviour, this will demotivate him (he will not enjoy reading or feel he is achieving enough), it will slow him

Motivation	Strategy	Outcome
Attention recommendation obligation attraction	Reading style browse skim/preview search/scan intense study review	Goal achievement personal objectives course assessment
Selection relevance to: course objectives personal objectives flavour context register	Purpose criticise memorise revise understand assignment make notes	Knowledge memory insights skills
Perseverance enjoyment achievement	Environment home, library, etc. distractions lighting, health comfort, etc.	Pleasure amusement excitement fascination

Fig. 2: Three aspects of the reading process.

down (prevent him from skimming, perhaps), and may result in a less satisfactory learning outcome (he may miss subtleties, or not perceive the overall structure of the argument).

A mismatch at the level of the access structure of the text would also affect reading behaviour in many ways. It might be hard for the student to see the relevance of the text to his needs, because he cannot overview the content. It will restrict his reading style because it assumes a relatively passive linear strategy. It will restrict the learning outcome because he cannot so easily read for specific purposes, and because the text, having no surface structure, offers him no aids to memory.

In summary, the quality of text presentation is a function of many interconnected factors. At present the discussion and control of these factors is rather arbitrary, being dependent more on the experiences, prejudices and philosophies that particular course team members happen to have, than on anything resembling a systematic approach. In addition, the tacit assumptions and the tensions inherent in a rather conservative production system can make innovation unduly problematic. Text quality is dependent on a match between reader and text, and the research, planning, production and testing of texts should aim to minimise potential mismatches. But the various dimensions of quality in texts (Fig 1) do not necessarily correspond directly with particular stages in the reading process (Fig 2). This is because the component factors of any model of the reading process contain elements largely outside of the control of the producers of texts - elements determined by the context, strategy, purposes and achievements of the reader. Nevertheless, they are factors which producers of text should endeavour to understand and predict.

References

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